$$K = \sum_{l \in \mathcal{K}} K_l = \sum_{l \in \mathcal{K}} A_l \frac{\sin \frac{3\pi}{2M}}{\sqrt{M} \sin\left(\frac{\pi}{M}(k - l + \frac{1}{2})\right)} e^{j\pi(k-l+\frac{1}{2})(-1+\frac{1}{M})}(-1)^{k-l} \qquad (51)$$

It turns out that not all the charged channels have to be taken into consideration. It is generally sufficient merely to take into consideration the channels within a certain range about the fade-out range.

Generally speaking, the fade-out range will extend over several subbands. In this event, each subband $k\frac{2\pi}{M} \leq \theta < (k+1)\frac{2\pi}{M}$, $k \in \mathcal{U}$, must be provided with a compensation filter $G_k(e^{j\theta})$ of its own with appropriate excitation. The indices of all the subchannels in which a compensation pulse is to be transmitted are summed up in the quantity U.

If the compensation pulse $g(n)$ is directly implemented as a FIR filter, each coefficient of the filter must be multiplied by the excitation. With long filter lengths the calculation they imply becomes unacceptable. A more efficient implementation is possible, when it is taken into consideration that the compensation pulse can be represented as a linear combination of the base functions h_l, $l \in L$ (compare equation (19)).

$$Kg = K[g_0^T 0_P g_1^T 0_P \dots g_{R-1}^T]^T = K[H^T c_0^T 0_P H^T c_1^T 0_P \dots H^T c_{R-1}^T]^T \qquad (52)$$

The matrix $\boldsymbol{H}$ is defined in the equation (20). The columns of the matrix $\boldsymbol{H}$ are the base functions

of the linear combination. K is the necessitated excitation of the compensation pulse as it has been calculated in the previous chapter. Substituting (20) yields

$$Kg = K\left[\begin{pmatrix} h_{l_0}^T \\ h_{l_1}^T \\ \vdots \\ h_{l_{L-1}}^T \end{pmatrix} \cdot c_0^T \; 0_P \; \begin{pmatrix} h_{l_0}^T \\ h_{l_1}^T \\ \vdots \\ h_{l_{L-1}}^T \end{pmatrix} \cdot c_1^T \; 0_P \; \ldots \; \begin{pmatrix} h_{l_0}^T \\ h_{l_1}^T \\ \vdots \\ h_{l_{L-1}}^T \end{pmatrix} \cdot c_1^T\right]^T . \tag{53}$$

The above equation signifies that the base functions h_l, $l \in L$ must be excited with $K\,c_o^T$ at the time of transmission of the actual data block. At the time of transmission of the next data block, these base functions must be modulated with $K\,c_1^T$, and so on. This is only true when zero blocks only are sent after the first block. In normal transmission operation, the excitation vectors $v(n)$ are calculated by convolution at the instant of time n, compare also *Fig. 20* in this connection.

$$v(n) = \sum_{l=0}^{R-1} K(n-l)c_l \tag{54}$$

Overlapping of the discrete excitation sequences is occasioned by the length of the compensation pulse. If the length of the compensation pulse $g(n)$ exactly equals one symbol period (M taps), the excitation vector v_n becomes $v(n) = K(n)c_o^T$.

The base function h_l, $l \in L$ is nothing else than the transmission functions of the IDFT channel l, scaled with $\sqrt{M}$. At the instant of time n, the channels l, $l \in L$, of IDFT must be occupied with $\sqrt{M}\ v(n)$.

If the fade-out range extends over several subbands, the above factorization is necessary for each compensation filter. If one base function is contained in several compensation filters, the excitations for this base function have to be summarized.

Fig. 33 shows another embodiment of the method according to the invention.

In this method, at least part of the subcarriers contained in at least one fade-out range and of the subcarriers adjacent to said fade-out range respectively are used as compensation sounds, their charge being calculated in such a way that the integral of the weighted, transmitted power density spectrum is minimized over the entire frequency range.

The subcarriers that are not used for transmitting information thus form compensation sounds which allow the power density spectrum within the fade-out range to be reduced. The number of fade-out ranges within the frequency band intended to be used for transmission is submitted to no restriction whatever. Not all of the subcarriers contained in a fade-out range need to be actually used as compensation sounds, if it is not necessary. When fade-out ranges are very closely adjacent, it is also conceivable to use the subcarriers of one fade-out range as compensation sounds within the neighboring fade-out range.

The computation of the charge of the compensation sounds is based on the considerations set forth below.

In a conventional DMT-transmission system, the modulation of the subcarriers is carried out through an Inverse Discrete Fourier Transform (IDFT). On application of the sequence $A_u[m]$ on the sound u, the output of IDFT is given by